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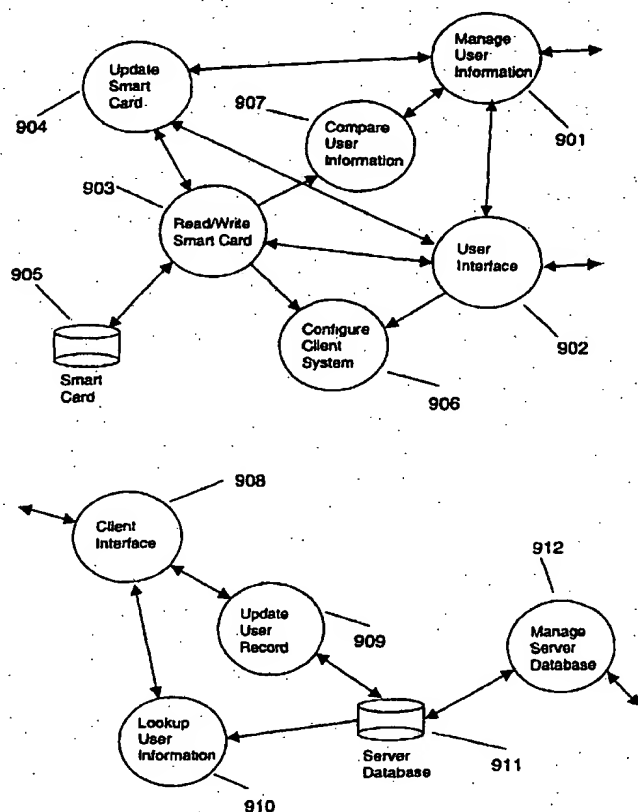
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(54) Title: SMART CARD ENABLED MOBILE PERSONAL COMPUTING ENVIRONMENT SYSTEM



(57) Abstract: A smart card enabled mobile personal computing environment system stores a user's personalized, fully functional, computing environment in a smart card. A user information database is provided that is resident on a server and contains the user records of a plurality of users containing personal computing environment data with the amount of data in the user record generally larger than the storage capacity of a smart card. The user specifies the information required to configure the client to the user's preferred personal computing environment. If the correct personal computing environment data is not resident in the smart card, the client queries the server for the information needed and updates the smart card with the new data. The user also manages his personal computing environment data stored on the smart card and the user information database. The server gives the client access to the user's records through a secure Web site. The user accesses his data, adds, modifies, and/or deletes information and transfers data to his smart card via the secure Web site. If the client has a slow or temporary connection with the server, the client is able to accommodate the user's data management needs by downloading the user's records stored on the server's user information database. The user can then manage his data without a connection to the server. Any changes to the user's records are later sent to the server to update the user information database.

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*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

# Smart Card Enabled Mobile Personal Computing Environment System

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## CROSS REFERENCE TO RELATED APPLICATIONS

This application Claims benefit of U.S. Provisional Patent Applications Serial No. 60/185,276, filed on February 28, 2000 (2161PRVB) and Serial No. 60/185,278, filed on February 28, 2000 (2161PRVC).

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## BACKGROUND OF THE INVENTION

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### TECHNICAL FIELD

The invention relates to mobile computing in a computer environment. More particularly, the invention relates to storing, managing, and retrieving a mobile computer user's personal computing environment in a smart card.

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### DESCRIPTION OF THE PRIOR ART

The current computing environment requires users, in general, to physically carry either a laptop or a notebook portable computer in order to maintain a fully functional, truly personalized, computing environment when moving from place to place. Because laptop and notebook computers, though physically small, are comparatively bulky and heavy, mobile computer users continuously seek ever smaller and lighter devices that will provide and maintain their personalized computing environment.

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An example of such a smaller and lighter device that has recently enjoyed significant commercial popularity is the personal digital assistant ("PDA"). However, even though PDAs are smaller and lighter than laptop or notebook computers and provide a personalized computing environment, they do not presently offer the full functionality of desktop, laptop or notebook portable computers.

For example, when a PDA is removed from an environment in which a computer user has a fully functional computing environment, the PDA must first be loaded with an up-to-date image of data for pertinent portions of that environment, *e.g.*, an address book, calendar, email, etc. Similarly, when a PDA returns to the fully functional computing environment, data in the PDA that has changed since leaving the fully functional computing environment must be transferred and/or synchronized from the PDA back into the user's regular computer and vice versa.

Desktop computers capable of accessing the Internet are ubiquitous in industrialized countries worldwide. A computer user, while traveling, can usually obtain access to such a computer and use that computer's Internet access to communicate worldwide. With sufficient data and appropriately configured, such computers could, in principle, provide mobile computer users with a fully functional personal computing environment. However, establishing a mobile computer user's fully functional computing environment at a remote or transitory location, *e.g.*, in an airport kiosk or overnight lodging, requires error-free entry of a prodigious amount of highly detailed information to configure the local computer.

The amount of information required to configure a local computer so it provides the mobile computer user's fully functional, personal computing environment is disproportionately large in comparison with the benefit obtained. Consequently, there presently does not exist any convenient hardware and software that permits mobile computer users to move from computer to computer anywhere in

the world, carrying with them their personalized, fully functional computing environment.

Presently, smart cards are used primarily for facilitating financial transactions.

5 However, because smart cards include at least a limited amount of non-volatile readable and writeable memory and may also include a programmable processor, they inherently possess a capability for use in applications other than financial transactions. Storing data into a smart card, accessing that data, and  
10 activating a smart card's processor to execute a computer program all require that the smart card be interconnected with some type of reader/terminal. This characteristic of smart cards limits the potential for broadening their use for mobile computing applications because, in general, there does not presently exist an infrastructure that supports the use of smart cards for applications other than financial transactions.

15 It would be advantageous to provide a smart card enabled mobile personal computing environment system that allows a user to store and transport his personal computing environment in a smart card and to use the smart card to configure the computing environment of a computer. It would further be  
20 advantageous to provide a smart card enabled mobile personal computing environment system that creates an infrastructure for the management of a user's personal computing environment data on a smart card.

## 25 SUMMARY OF THE INVENTION

The invention provides a smart card enabled mobile personal computing environment system. The system allows a user to store, transport, and configure his personal computing environment via a smart card. In addition, the invention  
30 provides a secure infrastructure for the management of a user's personal computing environment data on a smart card. The user's personal computing

environment data is read from the smart card and used to configure a client computer.

5 A preferred embodiment of the invention stores a user's personalized, fully functional, computing environment in a smart card. A user information database is provided that is resident on a server and contains the user records of a plurality of users. Each of the user records contain personal computing environment data. The amount of data in the user record is generally larger than the storage capacity of a smart card.

10

The invention allows the user to specify the information required to configure the client to the user's preferred personal computing environment. If the correct personal computing environment data is not resident in the smart card, the client queries the server for the information needed and updates the smart card with  
15 the new data. If the smart card memory is filled, then the client will remove old indices from the smart card in a least recently used method until there is enough room to add the new data.

20 The user can also manage his personal computing environment data stored on the smart card and the user information database. The user is allowed to increase the size of his user records to store more information and to create sets of personal computing environment data.

25 The server gives the client access to the user's records through a secure Web site. The user accesses his data, adds, modifies, and/or deletes information and transfers data to his smart card via the secure Web site.

30 If the client has a slow or temporary connection with the server, the client is able to accommodate the user's data management needs. The client downloads the user's records stored on the server's user information database. The user can then manage his data without a connection to the server. Any changes to the

user's records are later sent to the server to update the user information database.

- 5 A plurality of servers with redundant copies of the user information database are used in case of any server failures. One of the servers is designated the main local server of the user based on the user's usage patterns. The client performs load balancing among the servers when obtaining data and will automatically switch to another server if the main server fails or is otherwise inaccessible.
- 10 Other aspects and advantages of the invention will become apparent from the following detailed description in combination with the accompanying drawings, illustrating, by way of example, the principles of the invention.

### **BRIEF DESCRIPTION OF THE DRAWINGS**

5 Fig. 1 is a flowchart showing the execution flow of the client to server exchange when the user specifies the indices required for his personal computing environment according to the invention;

10 Fig. 2 is a flowchart showing the execution flow of the client to server exchange when the user specifies the indices required for his personal computing environment according to the invention;

15 Fig. 3 is a flowchart showing the schema for managing a user's personal computing environment data between a server database and a smart card according to the invention;

Fig. 4 is a block schematic diagram showing the user's indices accessible on a client and a server according to the invention;

20 Fig. 5 is a block schematic diagram showing the exchange of the user's indices between a client and a server according to the invention;

25 Fig. 6 is a block schematic diagram showing the exchange of data between the user's smart card, a client, a server, and a redundant server when a user index is deleted according to the invention;

Fig. 7 is a block schematic diagram depicting a scenario when the server responsible for a particular user is switched when the user relocates according to the invention;



Fig. 8 is a block schematic diagram of a task-oriented viewpoint of a preferred embodiment of the invention illustrating the client and server tasks for a server-based data management system according to the invention; and

- 5 Fig. 9 is a block schematic diagram of a task-oriented viewpoint of a preferred embodiment of the invention illustrating the client and server tasks for a client-based data management system according to the invention.

## DETAILED DESCRIPTION OF THE INVENTION

5 The invention is embodied in a smart card enabled mobile personal computing environment system in a computer environment. A system according to the invention allows a user to store, transport, and configure his personal computing environment via a smart card. In addition, the invention provides a secure infrastructure for the management of a user's personal computing environment data on a smart card.

10

The invention provides a mobile computer user with a system that is extremely compact, and yet permits the user to carry with him sufficient machine readable data to easily establish his fully functional mobile personal computing environment anywhere in the world.

15

A preferred embodiment of the invention stores, in a smart card, sufficient information to permit characterizing a mobile computer user's personalized, fully functional computing environment. The information that the mobile personal computing environment supplies may differ from system to system. However, 20 the amount of information stored in the smart card is sufficient to create a consistent computing environment for the user. Information such as operating system preferences, favorite Web sites, email addresses, credit card information, ISP information, program preferences, program environments, etc. are stored in the smart card.

25

Referring to Fig. 1, the user activates the invention's client computer program through an auto launch at boot-up 101 or through a manual launch 102 when he begins to use a client computer. A smart card reader/terminal is connected to, or resident in, the user's computer, reading the user's smart card. The client 30 computer program retrieves indices from the smart card 103. The user specifies

to the invention the data needed to establish at least a portion of his mobile personal environment through the invention's user interface 104.

5 The invention checks the smart card to determine if the specified data is present in the smart card's local memory 105. If the specified data is in the smart card's memory, then the invention retrieves the data from the smart card for subsequent use by the invention 106. If the specified data is not in the smart card's memory, then the invention accesses, via the Internet or other method, a secure server that stores additional data which more fully characterizes the mobile computer user's personalized, fully functional computing environment 108. The invention then retrieves the specified data from the server for subsequent use by the invention 109 and updates the smart card data 110. If the data is not on the server 108, then it is new data from the user which must be recorded and used to access the Internet 111.

15 With respect to Fig. 2, having retrieved the required data either from the smart card, the server, or directly from the user, the client computer program uses the data to construct a Uniform Resource Locator (URL) 201 and, if possible, gather the username, password, and Internet site bookmark data needed to immediately and directly access an Internet site that constitutes at least some part of the mobile computer user's mobile personal environment 202.

25 Using the data constructed in this way, the invention then builds a URL command and sends it to the Internet 203. The URL, username, password and Internet site bookmark data, if complete, permit the mobile computer user to log onto the specified Internet site 204 and proceed immediately to a specified page at that Internet site 205. If some information is incorrect or incomplete, interacting with the Internet site accessed by the URL, the mobile computer user can either enter, as required, the username, password, and Internet page data to access a desired Internet page 207, 208, or may supply that information through

a graphical user interface (GUI) that provides a drag and drop capability 210, 211.

Referring to Fig. 3, to initialize or update indices stored on the smart card, the user activates the invention's client computer program 301, 302, instructing the program to access, via the Internet or other method, the server that stores additional information which characterizes a mobile computer user's personalized, fully functional computing environment 303. The server permits the user to change data characterizing his personalized mobile personal environment 304, for example, adding a new Internet site to his environment. After the user specifies changes to be made in his mobile personal environment, the server links to the specified Internet site and determines updated indices for storage on the smart card 305.

After linking to the specified Internet site and updating the computing environment information stored at the server 306, the invention attempts to update the indices stored on the user's smart card connected to his computer 307. If the smart card memory is full 309, then one record is deleted from those stored in the smart card until the smart card has sufficient free memory to store the updated indices 311, the updated index is then written into the smart card's memory 310. Otherwise, if the smart card memory is not full 309, then the updated indices are immediately stored on the smart card 310. In addition to saving the updated indices on the smart card, the server also saves the updated index in its database which characterizes this mobile computer user's mobile personal environment 308.

If the amount of unused storage in the server's database is sufficient to store the updated indices 312, then the information is stored in the database 313. Otherwise, the server first offers the user an opportunity to allocate more server storage for his indices 314. If the user declines the offer of additional storage, then the server deletes one record from the database until the server has

sufficient free memory to store the updated indices 316. The server then adds the updated index to the indices stored in the database 315. If the user accepts the offer of additional storage 314, then the new index is added to the server's database 315. The mobile computer user is able to initially specify and, as  
5 required, update data that characterizes his mobile personal environment.

The user is allowed to create sets of indices when storing a larger amount of information on the server than is available on the user's smart card. The user can then choose between different sets of information to be downloaded to his  
10 smart card. For example, the user can set his smart card to his personalized mobile computer environment for his U.S. office, foreign office, or even his home. This allows the user to characterize each separate and distinct computer system that he uses.

15 One skilled in the art will readily appreciate that although the mobile computer user's personalized computer environment is specifically mentioned above, any other type of information, such as personal data, financial data, operating system, computer personality, video and/or audio data, etc., are easily substituted in its place.

20 With respect to Fig. 4, the invention provides an infrastructure that permits using smart cards for applications other than financial transactions. The smart card 404 is interconnected with a smart card reader/terminal that can communicate via the Internet, extranet, or intranet 402. Using this device 401, a computer  
25 user specifies characteristics for some computing function. Presuming that the reader/terminal is connected to the user's personal computer, an index for the specified computing function is stored into that computer's memory 403. Also, the index is stored both into the smart card 404 and into a server accessible via the Internet, extranet, or intranet 402, 405, 406.

30

Referring to Fig. 5, in general, the smart card stores only a fraction of a computer user's total indices since smart cards possess only a limited amount of memory. When those indices completely fill the available smart card memory 504, addition of another index causes the least recently used index to be deleted from the smart card's memory 504. However, because the server may, in principle, store more indices 505 than the smart card 504, the index discarded from the smart card 504 can remain stored and accessible at the server 502, 506. In this way, the smart card 504 carries indices that characterize at least some fraction of computing functions specified by individual computer users 503, 505, thereby making those functions accessible to the computer user worldwide 506 at any suitably programmed smart card reader/terminal.

With respect to Fig. 6, in accessing a pre-specified computer function, the smart card 604 is placed in a suitably programmed reader/terminal 601 from which the index stored in the smart card 604 is transferred to that reader/terminal or host computer device's memory 603. If the requested index is not present in the smart card's memory 604, the device 601 then accesses the server 602 via the Internet, extranet, or intranet 607 to retrieve the index that is stored there 606. Because retrieving a particular index from the server 602 makes it the most recently used index, the device 601 transfers the index both to the device's memory 603 and replaces the least recently used index 605 in the smart card's memory 604 with the most recently used index. If a new index is added to the server database 606 when the database 606 is full, the system either discards the least recently used index 608 or, if possible, gives the user the option to allocate more server storage for his records, as described above.

Another preferred embodiment of the invention adds a backup server 609 that contains a consistent copy of the entire user database 606 served by the main server 602. If the main server 602 fails, the backup server 609 takes over. The backup server's database 610 and external interface 611 are identical to the main server's 602 components.

Additionally, a plurality of servers can be used along with load balancing, to handle large amounts of client requests. The client can perform its own load balancing among the servers by using, for example, the response time (RTT) from each server to determine the best choice. If the main server serving the user fails or is otherwise inaccessible, then the client will automatically switch to another server.

Referring to Fig. 7, to efficiently utilize server resources distributed at various locations throughout the world, the invention records places in the world from which a user accesses his mobile personal environment. Recording such data permits the server to reasonably determine that a user has moved from one place to another, *e.g.*, from the United States to Japan. For example, if a user who had previously accessed his mobile personal environment 704 mostly from the United States 701, 702, 703 suddenly began accessing that environment 704, 709 entirely from Japan 706, 707, 708 for an extended interval of time, *e.g.*, one or two months, then the server 704 can reasonably determine that the user has moved from the United States to Japan. If the server 704 determines that the user has relocated his residence and if there exists another server 709 that is located physically closer to the user's new residence, then the systems operating on both servers 704, 709 effect a transfer of the user's mobile personal environment indices 705 from the more remote server 704 to the nearer server 709.

The invention allows mobile computer users to carry, on a single smart card, all the information required to characterize their mobile personal environment and to quickly establish their mobile personal environment anywhere in the world.

With respect to Fig. 8, a high-level task viewpoint of a preferred embodiment of the invention is shown. The user plugs his Smart Card 805 into the smart card reader that is connected to, or resident in, the client computer. The Configure

Client System module 806 reads the Smart Card 805 through the Read/Write Smart Card module 803. The Configure Client System module 806 either automatically configures the client computer to the user's personal computing environment or queries the user through the User Interface 802 for the information needed from the Smart Card 805 to configure the user's personal computing environment (as described above), depending on the user's preference settings.

The user can also manage the indices stored on his Smart Card 805 and the Server Database 811. The Server Interface module 801 communicates with the secure server containing the user's information. The communication is through the secure Web site provided by the Manage User Information module 807 on the server. The Manage User Information module 807 displays the user's indices stored on the Server Database 811. The user requests his indices through the secure Web site. His indices are retrieved from the Server Database 811 by the Lookup User Information module 810. The Lookup User Information module 810 relays the index information to the Manage User Information module 807. The indices resident on the user's Smart Card 805 are sent to the Manage User Information module 807 through the Server Interface 801. The smart card indices are compared with the user's indices from the Server Database 811 by the Compare User Information module 808, which correlates and compares any differences between the two sources. The Manage User Information module 807 displays the information to the user through a secure Web page.

The user can create (for new users), add, delete, and update his indices through the User Interface module 802 connection to the secure Web page. The Server Database 811 indices are updated through the Update User Record module 809. Smart Card indices are updated by the Manage User Information module 807 through the Server Interface 801. The Server Interface 801 sends the update information to the Update Smart Card module 804. The Update Smart Card



module 804 writes the information to the Smart Card 805 through the Read/Write Smart Card Module 803.

5 In the case of multiple servers, the Server Database 811 is redundantly stored among other servers. The Server Database 811 is updated with information from other servers by the Manage Server Database module 812. Any new updates to the Server Database 811 that are initiated locally are sent out to other servers by the Manage Server Database module 812.

10 Additionally, any transfers of user index records from one server to a more local server (in case of the user relocating to another location) is performed by the Manage Server Database module 812.

15 Referring to Fig. 9, another preferred embodiment of the invention is shown that performs that same basic functions as those described in Fig. 8, except that the client has a server connection that is most likely temporary in nature, *e.g.*, a dialup modem connection. The difference in operation between Figs. 8 and 9 is when the user manages his indices on his smart card and server database. The client connects to the Client Interface module 908 on the server through the  
20 Manage User Information module 901, resident on the client. The Client Interface 908 collects the user's indices for the Manage User Information module 901. The user's records are retrieved from the Server Database 911 by the Lookup User Information module 910.

25 Once the user's indices are received by the Manage User Information module 901, the client can disconnect from the server and the user manages his indices offline with the client. The Compare User Information module 907 operates in the same manner as described above. The information obtained from the Server Database 911 and the Smart Card 905 are displayed to the user through the  
30 User Interface 902. After the user has updated his indices and any changes to the user's records on the Server Database 911 are required, the client

reconnects with the server's Client Interface 908. The Server Database 911 is updated with any changes by the Update User Record module 909.

Yet another preferred embodiment of the invention encrypts the entire Server Database 911. Each user record is individually encrypted such that if one user record is accessed and decrypted by a hacker, the other user records will not be compromised in any way. The actual encryption of a user record is performed by the client. The Manage User Information module 901 retrieves the user's encrypted record from the server. If this fails, then the user must create a new record to access. The server looks up, using the Smart Card's 905 ID, and retrieves the user's record through the Lookup User Information module 910. The server does not know what the contents of the record are, only that the record belongs to the user (much like a safety deposit box). The record is sent back to the client via the Client Interface module 908.

The Manage User Information module 901 decrypts the user record using the Smart Card 905 encryption key information stored in the Smart Card 905. Each smart card is unique and the encryption key only exists on a particular smart card and not on the server. Once the user has completed any changes to the indices in the record, the Manage User Information module 901 encrypts the user record using the encryption key on the Smart Card 905 and sends the record back to the server. The Client Interface module 908 sends the encrypted record to the Update User Record module 909 which replaces the user record in the Server Database 911 with the new encrypted user record.

This approach ensures that there is a one-to-one mapping of user records to smart cards; each user record in the Server Database 911 can only be decrypted by a specific smart card. It also ensures that the Server Database 911 is secure and cannot be easily compromised. The intruder would have to physically have every existing smart card to crack the entire database.

If a user loses his smart card, then there is a procedure where the smart card can be morphed, or recreated. The user inserts a new Smart Card 905 into the client system. The system through the User Interface module 902 has the user enter in his personal information in the same manner as when he first created his original smart card. The new Smart Card 905 is then initialized and the encryption key is recreated. The new smart card's ID is sent to the Client Interface module 908 from the User Interface module 902 via the Manage User Information module 901. The Update User Record module 909 removes the original smart card's ID from the user's record on the Server Database 911 and replaces it with the new smart card's ID. Once that is completed, the User Interface module 902 then places the encryption key in the new Smart Card 905 via the Read/Write Smart Card module 903. The user's smart card has now been recreated and the original smart card disabled.

15 The server has the ability to simultaneously perform the server functions described in Figs. 8 and 9. This allows the server to handle both secure Web access and clients that have temporary server connections.

20 One skilled in the art will readily appreciate that although the client and server functionality are described separately above, both the client and server can reside on the same physical machine.

25 Although the invention is described herein with reference to the preferred embodiment, one skilled in the art will readily appreciate that other applications may be substituted for those set forth herein without departing from the spirit and scope of the present invention. Accordingly, the invention should only be limited by the Claims included below.

**CLAIMS**

1. A process for storing, managing, and retrieving a mobile computer user's  
5 personal computing environment, transportable via a smart card, in a computer  
environment, comprising the steps of:  
    providing a smart card;  
    reading the user's personal computing environment data from said smart  
card;  
10      configuring a client according to said personal computing environment  
data; and  
    wherein said personal computing environment data includes, but is not  
limited to: operating system preferences, favorite Web sites, email addresses,  
credit card information, ISP information, program preferences, and program  
15 environments.
2. The process of claim 1, wherein said reading step further comprises the  
steps of:  
    accepting user input specifying the information required to configure said  
20 client to the user's preferred personal computing environment; and  
    retrieving the correct personal computing environment data from a server  
if said smart card does not have sufficient information to configure said client to  
the user's preferred personal computing environment.
- 25 3. The process of claim 2, further comprising the step of:  
    storing said correct personal computing environment data on said smart  
card.
4. The process of claim 1, further comprising the step of:  
30      providing a user information database resident on a server;

wherein said user information database contains the user records of a plurality of users; and

wherein said user records contain personal computing environment data of a size that can be larger than the storage capacity of said smart card.

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5. The process of claim 4, further comprising the step of:  
providing user record management means for allowing the user to manage the personal computing environment data stored on said smart card and said user information database.

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6. The process of claim 5, wherein said user record management means reside on said client, and wherein said client connects with said server to retrieve the user's records.

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7. The process of claim 5, wherein said user record management means reside on said server, and wherein said client connects with said server through a secure Web site.

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8. The process of claim 5, wherein said user record management means gives the user an option to expand the storage capacity of the user's user record on said user information database.

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9. The process of claim 5, wherein said user record management means allows the user to define sets of personal computing environment data.

10. The process of claim 4, wherein a plurality of servers contain redundant copies of said user information database.

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11. The process of claim 10, wherein said client performs load balancing between said plurality of servers when obtaining user records.

12. The process of claim 10, wherein a server is designated as the user's main local server.

13. The process of claim 12, wherein said main server is dynamically selected  
5 based on the user's usage patterns.

14. The process of claim 12, wherein said client automatically switches to another server if said main server fails or is inaccessible.

10 15. The process of claim 4, wherein each of said user records is encrypted using an encryption key from the specific owner's smart card, and wherein each of said specific smart card contains a unique encryption key resident only on said specific smart card.

15 16. The process of claim 15, wherein the encryption and decryption of a user record occurs on said client, and wherein said user records are only transferred between said client and said server in encrypted form.

17. The process of claim 1, further comprising the step of:  
20 providing morphing means for recreating a user's lost smart card.

18. An apparatus for storing, managing, and retrieving a mobile computer user's personal computing environment, transportable via a smart card, in a computer environment, comprising:

25 a smart card;

a module for reading the user's personal computing environment data from said smart card;

a module for configuring a client according to said personal computing environment data; and

30 wherein said personal computing environment data includes, but is not limited to: operating system preferences, favorite Web sites, email addresses,

credit card information, ISP information, program preferences, and program environments.

19. The apparatus of claim 18, wherein said reading module further  
5 comprises:

a module for accepting user input specifying the information required to  
configure said client to the user's preferred personal computing environment;  
and

10 a module for retrieving the correct personal computing environment data  
from a server if said smart card does not have sufficient information to configure  
said client to the user's preferred personal computing environment.

20. The apparatus of claim 19, further comprising:

15 a module for storing said correct personal computing environment data on  
said smart card.

21. The apparatus of claim 18, further comprising:

a user information database resident on a server;

20 wherein said user information database contains the user records of a  
plurality of users; and

wherein said user records contain personal computing environment data  
of a size that can be larger than the storage capacity of said smart card.

22. The apparatus of claim 21, further comprising:

25 user record management means for allowing the user to manage the  
personal computing environment data stored on said smart card and said user  
information database.

30 23. The apparatus of claim 22, wherein said user record management means  
reside on said client, and wherein said client connects with said server to retrieve  
the user's records.

24. The apparatus of claim 22, wherein said user record management means reside on said server; and wherein said client connects with said server through a secure Web site.

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22. The apparatus of claim 22, wherein said user record management means gives the user an option to expand the storage capacity of the user's user record on said user information database.

10

25. The apparatus of claim 22, wherein said user record management means allows the user to define sets of personal computing environment data.

26. The apparatus of claim 21, wherein a plurality of servers contain redundant copies of said user information database.

15

27. The apparatus of claim 26, wherein said client performs load balancing between said plurality of servers when obtaining user records.

20

28. The apparatus of claim 26, wherein a server is designated as the user's main local server.

29. The apparatus of claim 28, wherein said main server is dynamically selected based on the user's usage patterns.

25

30. The apparatus of claim 28, wherein said client automatically switches to another server if said main server fails or is inaccessible.

30

31. The apparatus of claim 21, wherein each of said user records is encrypted using an encryption key from the specific owner's smart card, and wherein each of said specific smart card contains a unique encryption key resident only on said specific smart card.



32. The apparatus of claim 31, wherein the encryption and decryption of a user record occurs on said client, and wherein said user records are only transferred between said client and said server in encrypted form.

5

33. The apparatus of claim 18, further comprising:  
morphing means for recreating a user's lost smart card.

34. A process for storing, managing, and retrieving a mobile computer user's personal computing environment, transportable via a smart card, in a computer environment, comprising the steps of:

10 providing reading means connected to a client for reading the user's personal computing environment data from said smart card;

15 providing means for configuring said client according to said personal computing environment data;

providing a user information database resident on a server;

wherein said user information database contains the user records of a plurality of users;

20 wherein said user records contain personal computing environment data of a size that can be larger than the storage capacity of said smart card;

wherein said personal computing environment data includes, but is not limited to: operating system preferences, favorite Web sites, email addresses, credit card information, ISP information, program preferences, and program environments;

25 providing user record management means for allowing the user to manage the personal computing environment data stored on said smart card and said user information database; and

providing smart card storing means for storing a portion of said user records on said smart card.

30

35. The process of claim 34, wherein said user record management means reside on said client, and wherein said client retrieves the user's records from said server.

5 36. The process of claim 34, wherein said user record management means reside on said server, and wherein said client connects with said server through a secure Web page.

10 37. The process of claim 34, wherein each of said user records is encrypted using an encryption key from the specific owner's smart card, and wherein each of said specific smart card contains a unique encryption key resident only on said specific smart card.

15 38. The process of claim 37, wherein the encryption and decryption of a user record occurs on said client, and wherein said user records are only transferred between said client and said server in encrypted form.

39. The process of claim 34, further comprising the step of:  
providing morphing means for recreating a user's lost smart card.

20

40. An apparatus for storing, managing, and retrieving a mobile computer user's personal computing environment, transportable via a smart card, in a computer environment, comprising the steps of:

25 reading means connected to a client for reading the user's personal computing environment data from said smart card;

means for configuring said client according to said personal computing environment data;

a user information database resident on a server;

30 wherein said user information database contains the user records of a plurality of users;

wherein said user records contain personal computing environment data of a size that can be larger than the storage capacity of said smart card;

wherein said personal computing environment data includes, but is not limited to: operating system preferences, favorite Web sites, email addresses, credit card information, ISP information, program preferences, and program environments;

user record management means for allowing the user to manage the personal computing environment data stored on said smart card and said user information database; and

smart card storing means for storing a portion of said user records on said smart card.

41. The apparatus of claim 40, wherein said user record management means reside on said client, and wherein said client retrieves the user's records from said server.

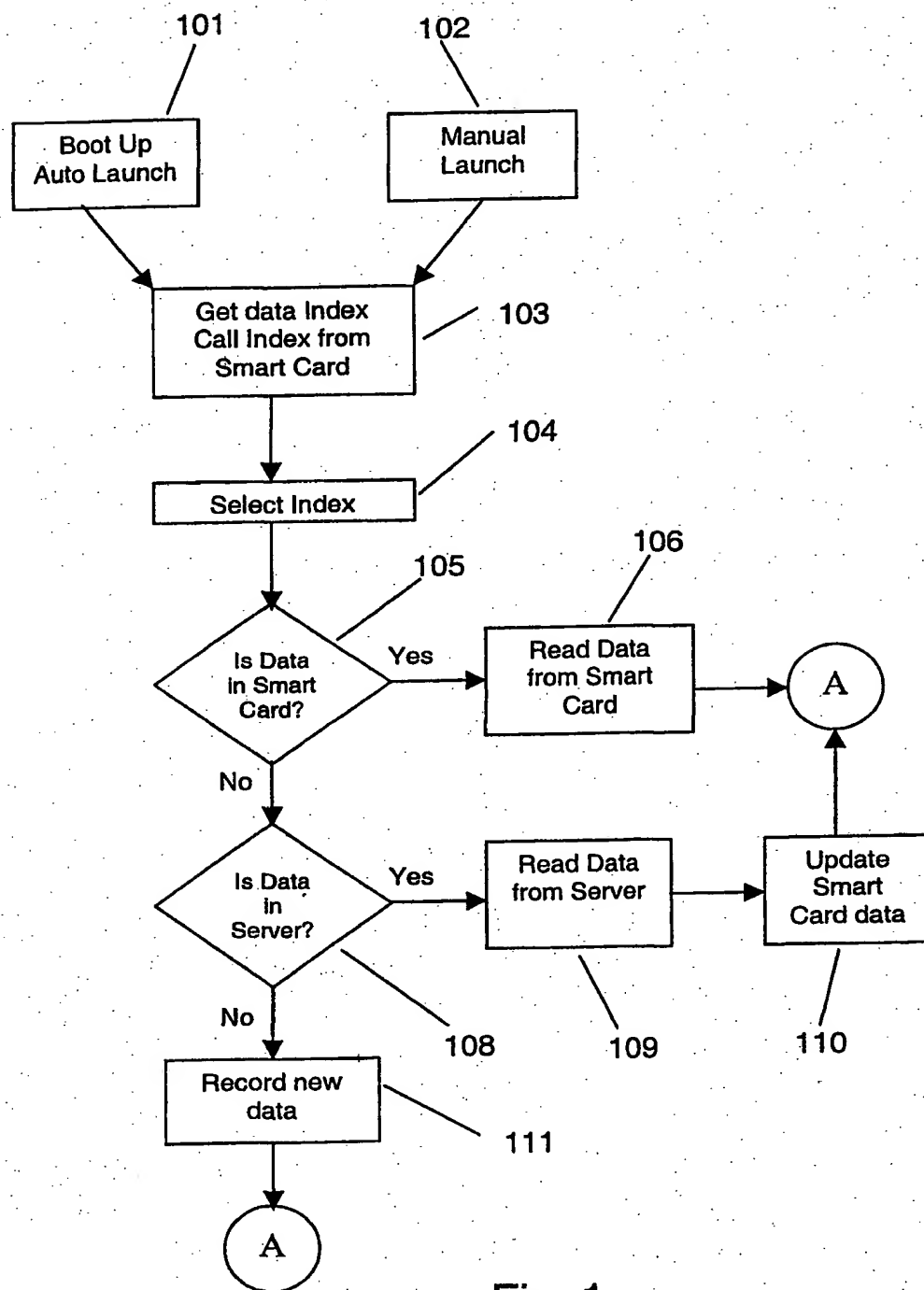
42. The apparatus of claim 40, wherein said user record management means reside on said server, and wherein said client connects with said server through a secure Web page.

43. The apparatus of claim 40, wherein each of said user records is encrypted using an encryption key from the specific owner's smart card, and wherein each of said specific smart card contains a unique encryption key resident only on said specific smart card.

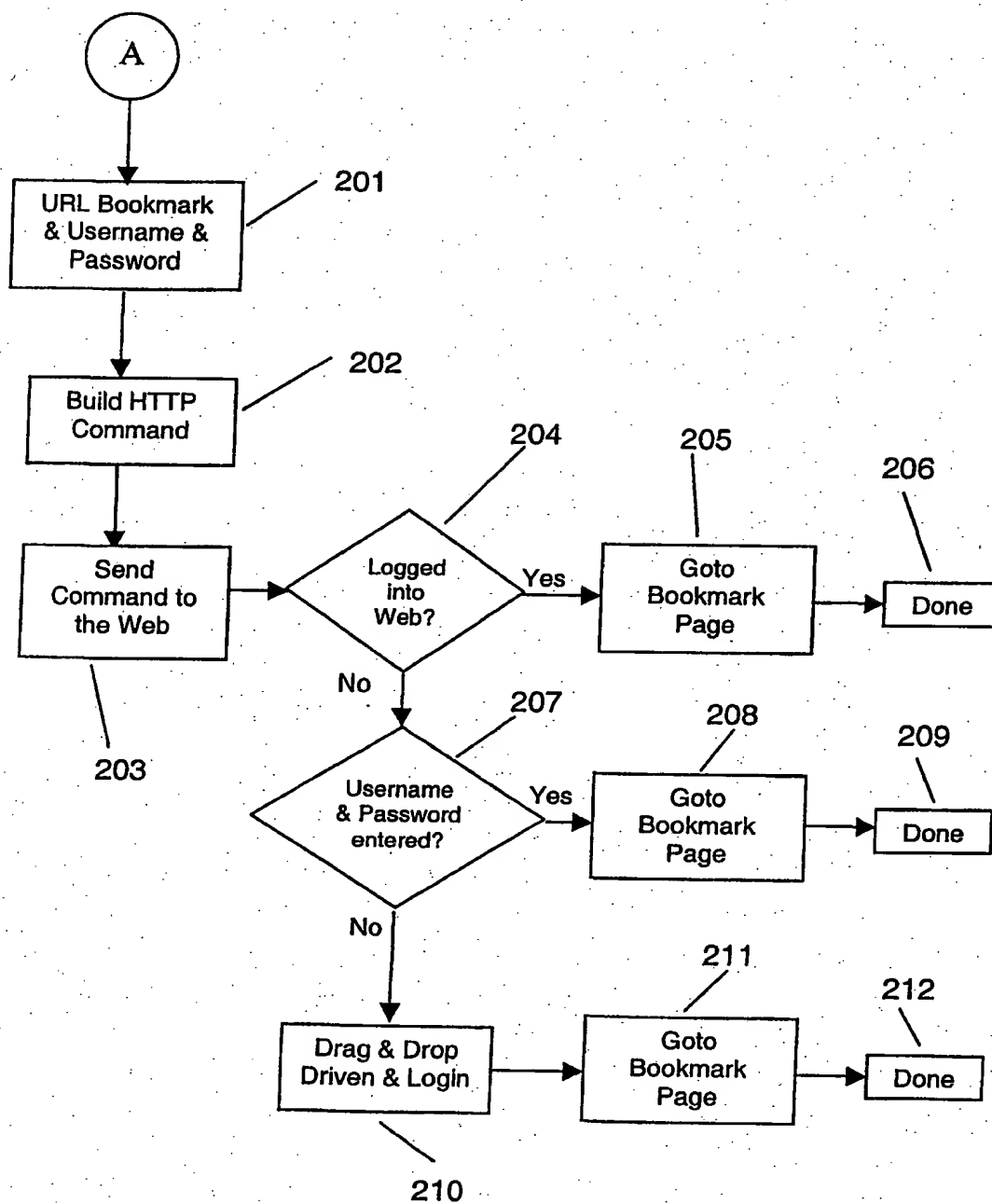
44. The apparatus of claim 43, wherein the encryption and decryption of a user record occurs on said client, and wherein said user records are only transferred between said client and said server in encrypted form.

45. The apparatus of claim 40, further comprising:  
morphing means for recreating a user's lost smart card.

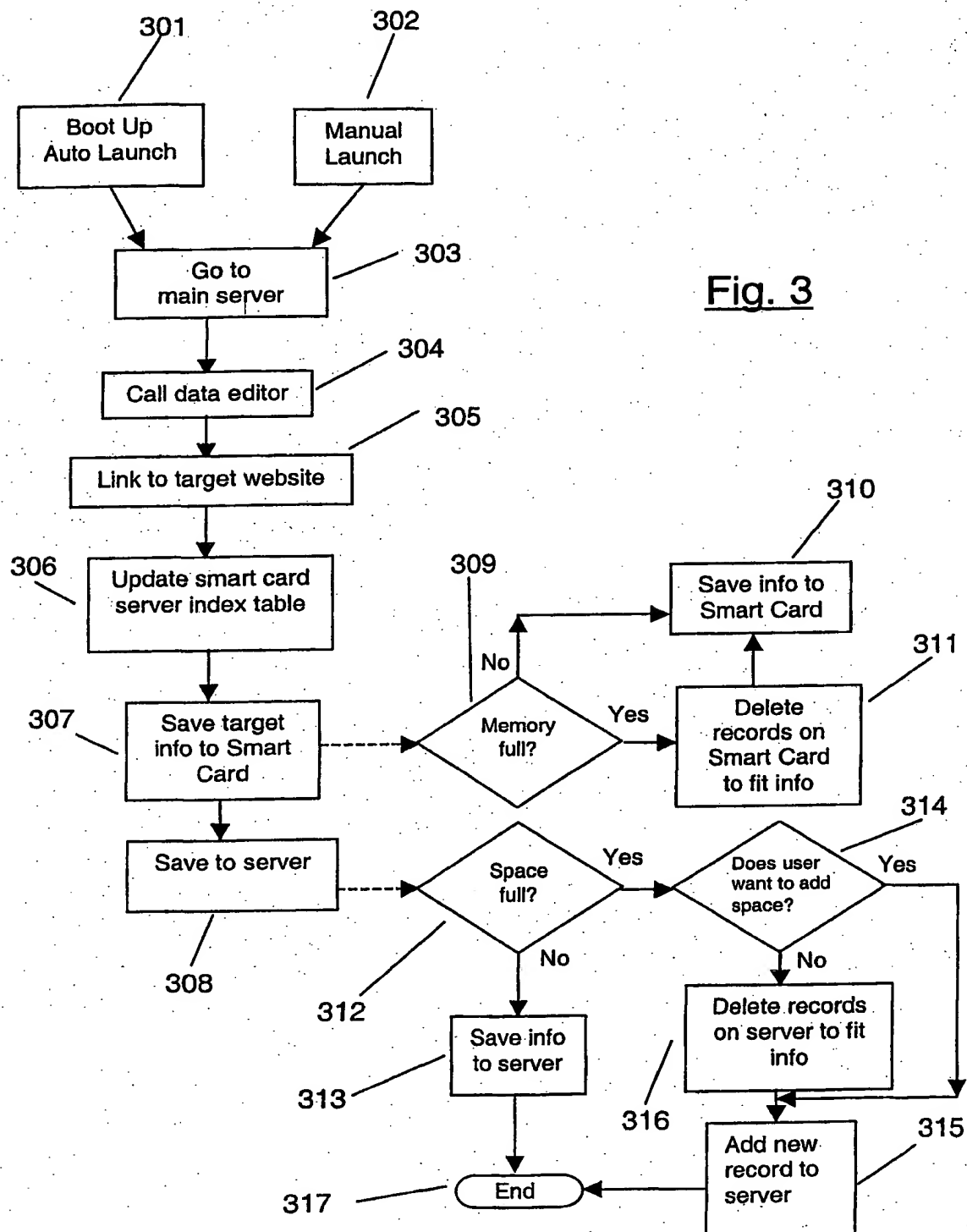
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Fig. 1

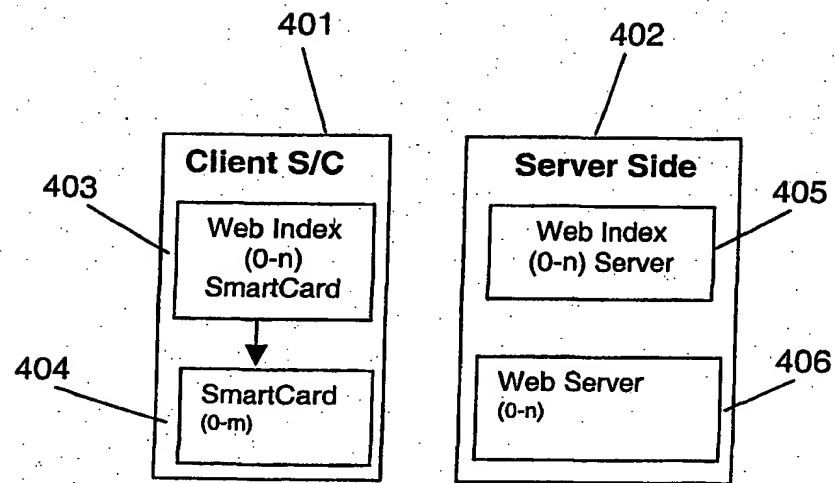
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Fig. 2

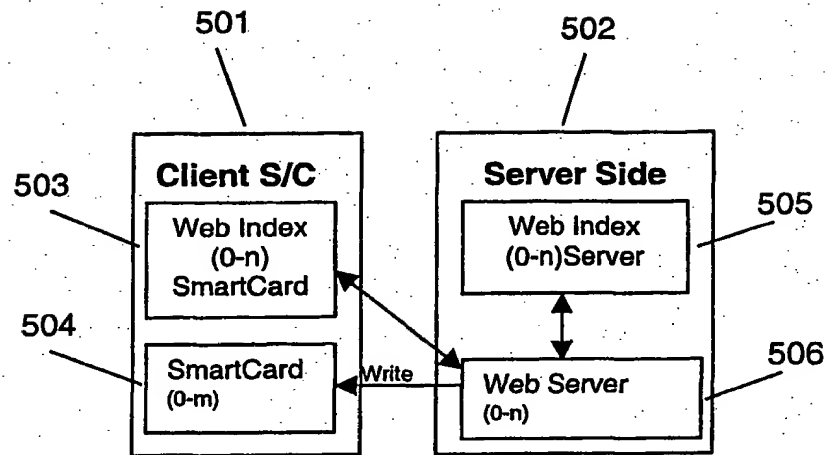
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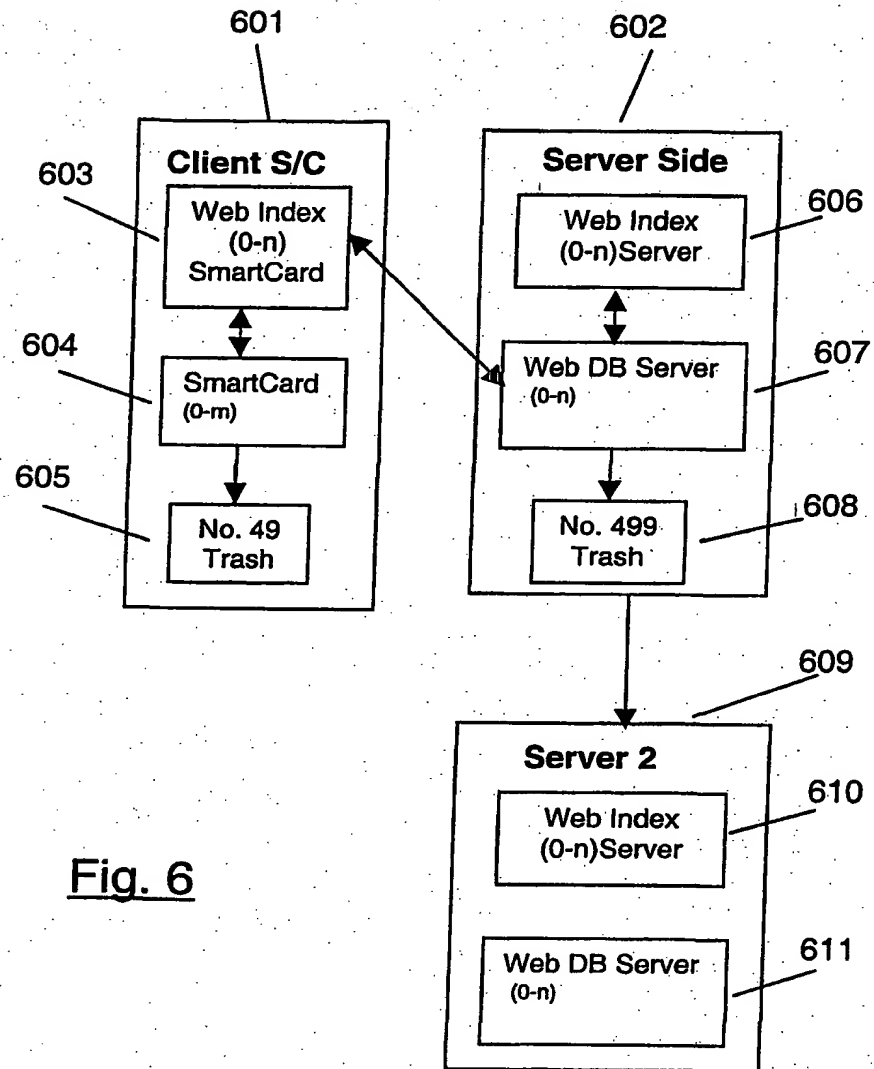
Fig. 4

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Fig. 5



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Fig. 6

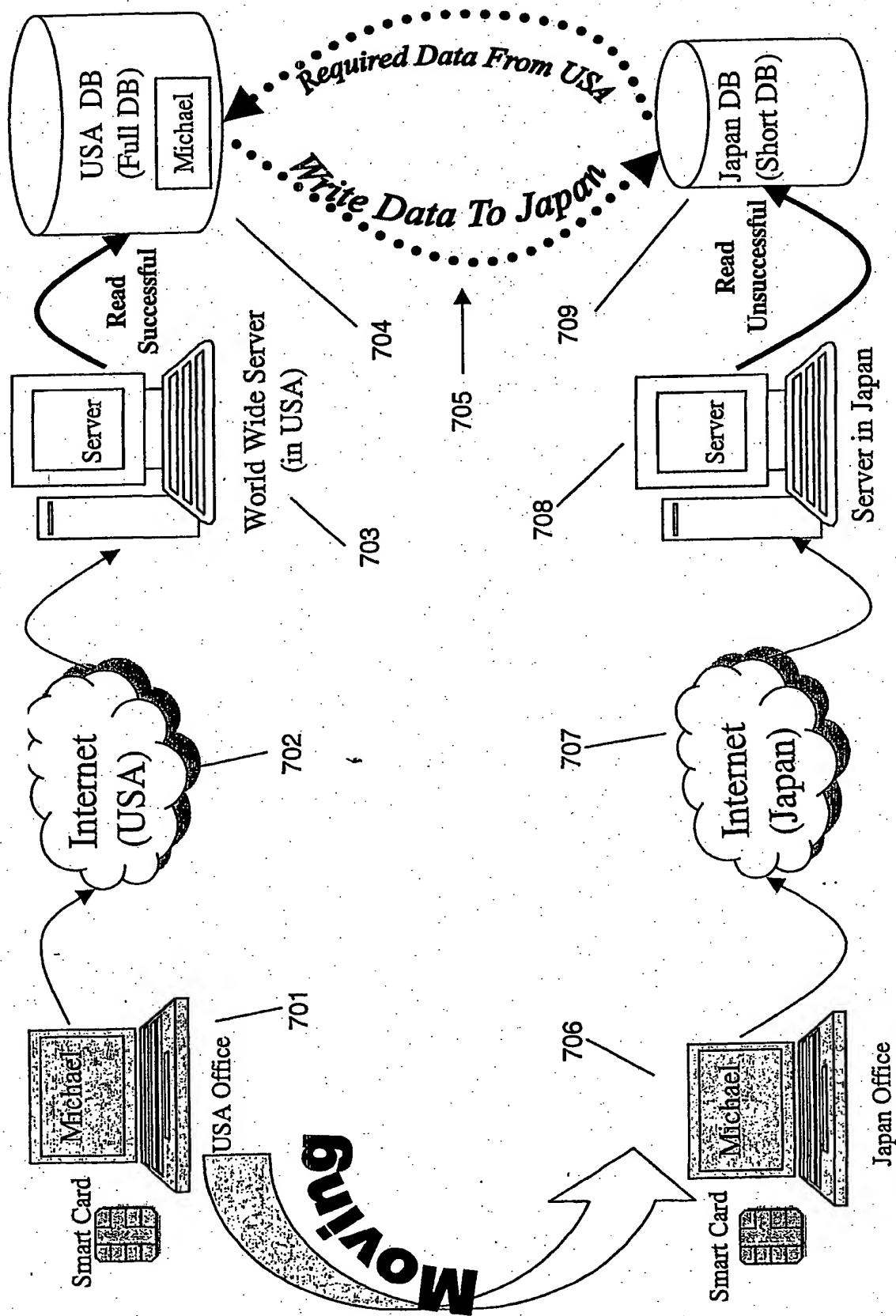


Fig. 7

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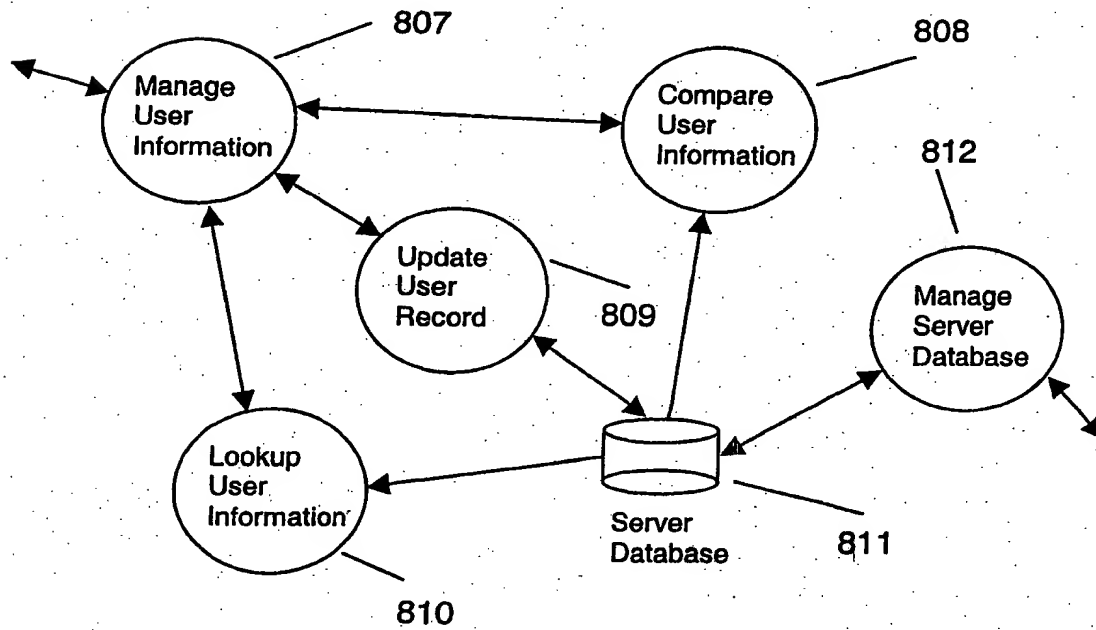
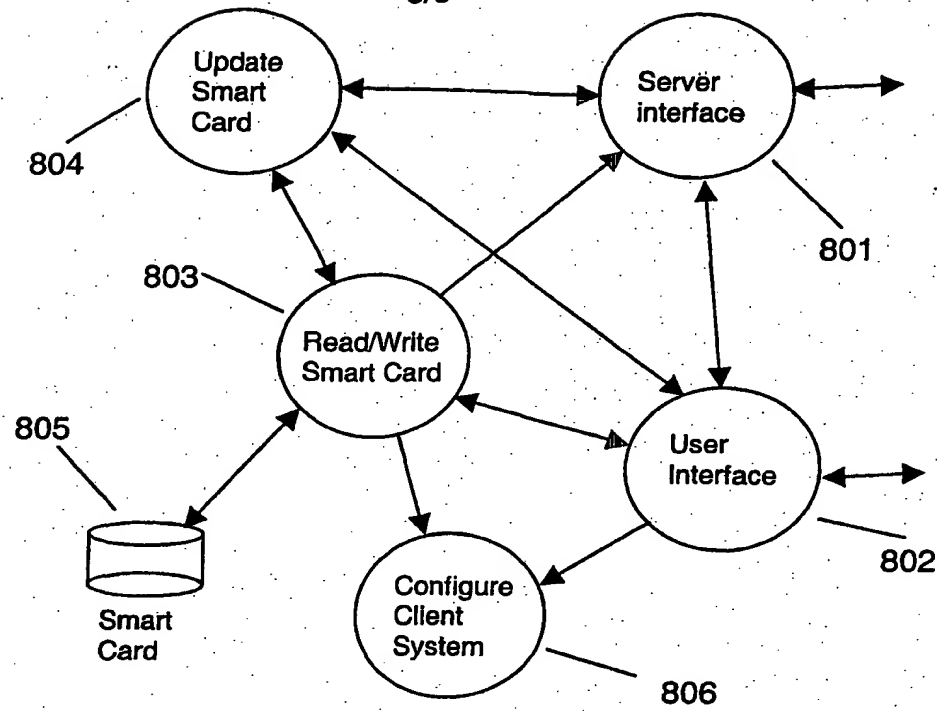
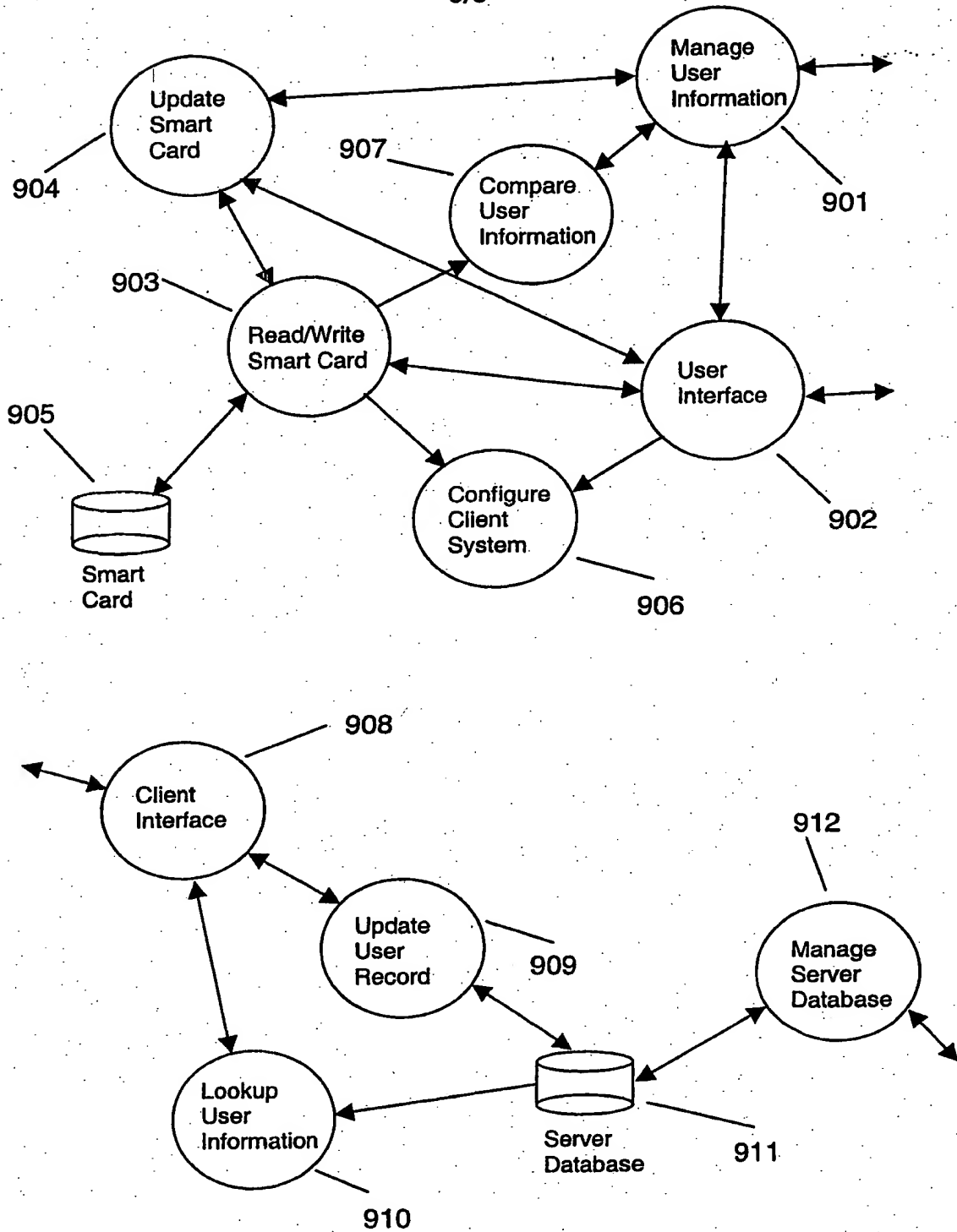


Fig. 8

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Fig. 9

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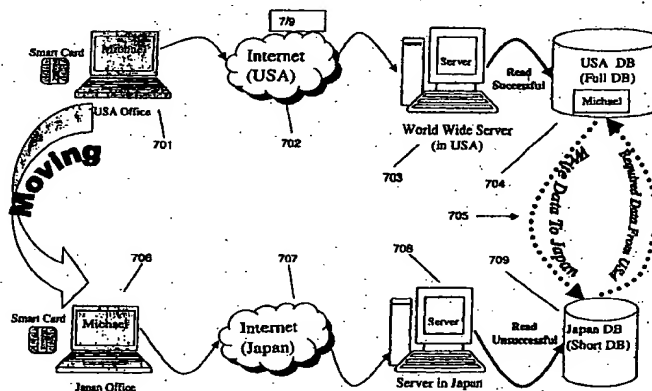
## Published:

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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: SMART CARD ENABLED MOBILE PERSONAL COMPUTING ENVIRONMENT



(57) Abstract: A smart card enabled mobile personal computing environment system stores a user's personalized, fully functional, computing environment in a smart card. A user information database is provided that is resident on a server and contains the user records of a plurality of users containing personal computing environment data with the amount of data in the user record generally larger than the storage capacity of a smart card. The user specifies the information required to configure the client to the user's preferred personal computing environment. If the correct personal computing environment data is not resident in the smart card, the client queries the server for the information needed and updates the smart card with the new data. The user also manages his personal computing environment data stored on the smart card and the user information database. The server gives the client access to the user's records through a secure Web site. The user accesses his data, adds, modifies, and/or deletes information and transfers data to his smart card via the secure Web site. If the client has a slow or temporary connection with the server, the client is able to accommodate the user's data management needs by downloading the user's records stored on the server's user information database. The user can then manage his data without a connection to the server. Any changes to the user's records are later sent to the server to update the user information database.

WO 01/065360 A3

## INTERNATIONAL SEARCH REPORT

International Application No  
PCT/US 01/06710

A. CLASSIFICATION OF SUBJECT MATTER  
IPC 7 G06F17/30

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)  
IPC 7 G06F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)  
EPO-Internal, WPI Data, PAJ, INSPEC, COMPENDEX, IBM-TDB, BIOSIS

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JAMEEL A ET AL: "Internet multimedia on wheels: connecting cars to cyberspace" INTELLIGENT TRANSPORTATION SYSTEM, 1997. ITSC '97., IEEE CONFERENCE ON BOSTON, MA, USA 9-12 NOV. 1997, NEW YORK, NY, USA, IEEE, US, 9 November 1997 (1997-11-09), pages 637-642, XP010270841 ISBN: 0-7803-4269-0 abstract; figure 1	1, 18
A	page 637, right-hand column, paragraph 2 -page 638, left-hand column, last paragraph --- -/-	2-17, 19-45



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Patent family members are listed in annex.

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Date of the actual completion of the international search

6 December 2002

Date of mailing of the international search report

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	GB 2 324 395 A (NEWS DATACOM LTD) 21 October 1998 (1998-10-21)	1, 18
A	abstract; figure 1  page 3, paragraph 1 -page 17, last paragraph	2-17, 19-45
A	WO 99 27681 A (MOTOROLA INC) 3 June 1999 (1999-06-03) abstract page 28, last paragraph page 34, paragraph 1 page 45, paragraph 3 -page 46, paragraph 3 page 49, paragraph 1 - paragraph 2	1-45

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International Application No  
PCT/US 01/06710

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GB 2324395	A	21-10-1998	AU WO	6515598 A 9847249 A2	11-11-1998 22-10-1998
WO 9927681	A	03-06-1999	AU EP WO	1702199 A 0962074 A1 9927681 A2	15-06-1999 08-12-1999 03-06-1999



## INTERNATIONAL SEARCH REPORT

International Application No  
PCT/US 01/06710

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X A	GB 2 324 395 A (NEWS DATACOM LTD) 21 October 1998 (1998-10-21) abstract; figure 1  page 3, paragraph 1 -page 17, last paragraph	1, 18  2-17, 19-45
A	WO 99 27681 A (MOTOROLA INC) 3 June 1999 (1999-06-03) abstract page 28, last paragraph page 34, paragraph 1 page 45, paragraph 3 -page 46, paragraph 3 page 49, paragraph 1 - paragraph 2	1-45

## INTERNATIONAL SEARCH REPORT

International Application No.

PCT/US 01/06710

Patent document cited in search report		Publication date		Patent family member(s)	Publication date
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